

THAT WHICH IS CLAIMED IS:

1 *add* 1. A process of producing a concentrated liquid biocide formulation which comprises
2 mixing together (a) bromine and (b) an aqueous solution of alkali metal salt of sulfamic acid
3 having a pH of at least about 12, in amounts such that (i) the active bromine content of the
4 solution is at least about 100,000 ppm (wt/wt), and (ii) the atom ratio of nitrogen to active
5 bromine from (a) and (b) is greater than 1.

1 2. A process according to Claim 1 wherein said aqueous solution of alkali metal salt
2 of sulfamic acid is an aqueous solution of the sodium salt of sulfamic acid.

1 3. A process according to Claim 1 wherein said aqueous solution of alkali metal salt
2 of sulfamic acid is formed by mixing together in water, (i) sulfamic acid and/or an alkali metal
3 salt of sulfamic acid, and (ii) alkali metal base in proportions such that an aqueous solution of
4 alkali metal salt of sulfamic acid is formed having a pH of at least about 12.

1 4. A process according to Claim 3 wherein said alkali metal base is a sodium base
2 such that said aqueous solution of alkali metal salt of sulfamic acid is an aqueous solution of
3 sodium salt of sulfamic acid.

1 5. A process according to Claim 3 wherein, at the time (i) and (ii) are mixed
2 together, the alkali metal base is in the form of a preformed aqueous solution of alkali metal
3 base, and (ii) is sulfamic acid in the form of a preformed slurry sulfamic acid in water.

1 6. A process according to Claim 5 wherein said preformed aqueous solution of alkali
2 metal base is a preformed aqueous solution of sodium base.

1 7. A process according to Claim 1 wherein said pH is in the range of from 12 to
2 about 13.5.

1 8. A process according to Claim 1 wherein said atom ratio is in the range of about
2 1.1 to about 1.5.

1 9. An aqueous biocide composition comprising water having in solution therein (i)
2 an active bromine content derived from bromine of at least about 100,000 ppm (wt/wt), (ii) an
3 alkali metal salt of sulfamic acid, and (iii) an alkali metal bromide, wherein the relative
4 proportions of (i) and (ii) are such that the atom ratio of nitrogen to active bromine is greater
5 than 1, and wherein the pH of the composition is at least about 12.

1 10. A composition according to Claim 9 wherein said pH is in the range of from 12
2 to about 13.5.

1 11. A process according to Claim 9 wherein said atom ratio is in the range of about
2 1.1 to about 1.5.

1 12. A composition according to Claim 9 wherein the alkali metal salt of sulfamic acid
2 is the sodium salt of sulfamic acid, and wherein the alkali metal bromide is sodium bromide.

1 13. A process of producing a concentrated liquid biocide composition, which process
2 comprises

- 3 A) continuously feeding into mixing apparatus (i) bromine and (ii) an aqueous solution of
4 alkali metal salt of sulfamic acid having a pH of at least about 12, proportioned to
5 produce an aqueous product having an active bromine content of at least 100,000 ppm
6 (wt/wt), and an atom ratio of nitrogen to active bromine from (i) and (ii) greater than 1,
7 and
8 B) withdrawing said product from said mixing apparatus at a rate sufficient to enable the
9 continuous feeding in A) to be maintained.

1 14. A process according to Claim 13 wherein (ii) in A) is an aqueous solution of the
2 sodium salt of sulfamic acid.

1 15. A process according to Claim 14 wherein said atom ratio is in the range of about
2 1.1 to about 1.5.

1 16. A process according to Claim 13 wherein said mixing apparatus comprises a static
2 mixer.

1 17. A process according to Claim 13 wherein said mixing apparatus comprises a vessel
2 equipped with a mechanical stirrer.

1 18. A process according to Claim 17 wherein said product is intermittently withdrawn
2 from said vessel.

1 19. A process according to Claim 17 wherein said product is continuously withdrawn
2 from said vessel.

1 20. A process of producing a concentrated liquid biocide composition, which process
2 comprises

- 3 A) continuously feeding into mixing apparatus (i) a bromine stream and (ii) a separate feed
4 stream of an aqueous solution of alkali metal salt of sulfamic acid having a pH of at least
5 about 12, in proportions that produce an aqueous product having an active bromine
6 content of at least 100,000 ppm (wt/wt), and an atom ratio of nitrogen to active bromine
7 from (i) and (ii) greater than 1, and
8 B) withdrawing said product from said mixing apparatus at a rate sufficient to enable the
9 continuous feeding in A) to be maintained; and
10 C) continuously, but alternately, withdrawing from at least one and then from at least one
11 other of at least two reaction vessels, an aqueous solution of alkali metal salt of sulfamic
12 acid at a rate that maintains said stream of (ii) in A), and during the time the solution is
13 being withdrawn from said at least one of at least two reaction vessels, forming additional
14 aqueous solution of alkali metal salt of sulfamic acid in said at least one other of at least
15 two reaction vessels from which solution is not then being withdrawn.

1 21. A process according to Claim 20 wherein said aqueous solution of alkali metal salt
2 of sulfamic acid is an aqueous solution of the sodium salt of sulfamic acid.

1 22. A process according to Claim 20 wherein said aqueous solution of alkali metal
2 wherein said atom ratio is in the range of about 1.1 to about 1.5.

1 23. A process according to Claim 20 wherein said mixing apparatus comprises a static
2 mixer.

1 24. A process according to Claim 20 wherein said mixing apparatus comprises a vessel
2 equipped with a mechanical stirrer.

1 25. A process according to Claim 24 wherein in B) said aqueous product is
2 intermittently withdrawn from said vessel.

1 26. A process according to Claim 24 wherein in B) said aqueous product is
2 continuously withdrawn from said vessel.

1 27. A process according to Claim 20 wherein said mixing apparatus comprises a static
2 mixer, and wherein said additional aqueous solution of alkali metal salt of sulfamic acid is
3 formed from an alkali metal base, sulfamic acid, and water.

1 28. A process according to Claim 20 wherein said mixing apparatus comprises a static
2 mixer, wherein said aqueous solution of alkali metal salt of sulfamic acid is an aqueous solution
3 of sodium sulfamate, and wherein said additional aqueous solution of alkali metal salt of sulfamic
4 acid is formed from a water-soluble sodium base, sulfamic acid, and water.

1 29. A process according to Claim 28 wherein said sodium base is an aqueous solution
2 of sodium hydroxide, and wherein the sodium sulfamate is formed as an aqueous solution by

charging to a reactor (i) an aqueous solution of sodium hydroxide, and (ii) a slurry of sulfamic acid in water, or (iii) separate charges of sulfamic acid and water, or (iv) both of (ii) and (iii).

30. A method for disinfecting a surface which comprises applying to said surface a concentrated liquid biocide composition comprised of (a) bromine and (b) an aqueous solution of alkali metal salt of sulfamic acid having a pH of at least about 12, in amounts such that (i) the active bromine content of said composition is at least about 100,000 ppm (wt/wt), and (ii) the atom ratio of nitrogen to active bromine in said composition is greater than 1.

31. A method according to Claim 30 wherein said concentrated liquid biocide composition is applied to said surface by pouring said concentrated liquid biocide composition onto said surface.

32. A method according to Claim 30 wherein said concentrated liquid biocide composition is applied to said surface by spraying said concentrated liquid biocide composition onto said surface.

33. A method according to Claim 30 wherein said concentrated liquid biocide composition is applied to said surface with an applicator.

34. A method according to Claim 30 wherein said aqueous solution of alkali metal salt of sulfamic acid is an aqueous solution of the sodium salt of sulfamic acid.

35. A method according to Claim 30 wherein said pH is in the range of from 12 to about 13.5.

36. A method according to Claim 30 wherein said aqueous solution of alkali metal salt of sulfamic acid is formed by mixing together in water (i) sulfamic acid and/or an alkali metal salt of sulfamic acid, and (ii) alkali metal base in proportions such that an aqueous solution of alkali metal salt of sulfamic acid is formed having a pH of at least about 12.

1 37. A method according to Claim 36 wherein said alkali metal base is a sodium base
2 such that said aqueous solution of alkali metal salt of sulfamic acid is an aqueous solution of the
3 sodium salt of sulfamic acid.

1 38. A method according to Claim 36 wherein, at the time (i) and (ii) are mixed
2 together, the alkali metal base is in the form of a preformed aqueous solution of alkali metal
3 base, and (i) is sulfamic acid in the form of a preformed slurry of sulfamic acid in water.

1 39. A method according to Claim 36 wherein said pH is in the range of from 12 to
2 about 13.5.

1 40. A process according to Claim 36 wherein said atom ratio is in the range of about
2 1.1:1 to about 1.5:1.

1 41. A method according to Claim 30 wherein the concentrated liquid biocide
2 composition further comprises an alkali metal bromide.

1 42. A method according to Claim 41 wherein the alkali metal is sodium.

1 43. A method of sanitizing a body of water which comprises introducing into said
2 body of water a concentrated liquid biocide composition comprised of (a) bromine and (b) an
3 aqueous solution of alkali metal salt of sulfamic acid having a pH of at least about 12, such that
4 (i) the active bromine content of said composition is at least about 100,000 ppm (wt/wt) and (ii)
5 the atom ratio of nitrogen to active bromine in said composition is greater than 1.

1 44. A method according to Claim 43 wherein said concentrated liquid biocide
2 composition is introduced directly into said body of water.

1 45. A method according to Claim 43 wherein said concentrated liquid biocide
2 composition is introduced into said body of water slowly over time.

1 46. A method according to Claim 43 wherein said concentrated liquid biocide
2 composition is introduced into said body of water via an apparatus through which the water is
3 circulated.

1 47. A method according to Claim 43 wherein the addition of said concentrated liquid
2 biocide composition to said body of water yields in the range of from about 2 to about 10
3 milligrams per liter of total available halogen, expressed as Cl_2 .

1 48. A method according to Claim 47 wherein the total available halogen, expressed
2 as Cl_2 , is in the range of from about 2 to about 5 milligrams per liter.

1 49. A method according to Claim 43 wherein the concentrated liquid biocide
2 composition is introduced into said body of water as required, such that in the range of from
3 about 2 to about 10 milligrams per liter of total available halogen, expressed as Cl_2 , is
4 maintained within said body of water.

1 50. A method according to Claim 49 wherein the total available halogen, expressed
2 as Cl_2 , is in the range of from about 2 to about 5 milligrams per liter.

1 51. A method according to Claim 43 wherein said pH is in the range of from 12 to
2 about 13.5.

1 52. A process according to Claim 43 wherein said atom ratio is in the range of about
2 1.1:1 to about 1.5:1.

1 53. A method according to Claim 43 wherein said aqueous solution of alkali metal salt
2 of sulfamic acid is an aqueous solution of the sodium salt of sulfamic acid.

1 54. A method according to Claim 43 wherein said aqueous solution of alkali metal salt
2 of sulfamic acid is formed by mixing together in water (i) sulfamic acid and/or an alkali metal

3 salt of sulfamic acid, and (ii) alkali metal base in proportions such that an aqueous solution of
4 alkali metal salt of sulfamic acid is formed having a pH of at least about 12.

1 55. A method according to Claim 54 wherein said alkali metal base is a sodium base
2 such that said aqueous solution of alkali metal salt of sulfamic acid is an aqueous solution of the
3 sodium salt of sulfamic acid.

1 56. A method according to Claim 54 wherein, at the time (i) and (ii) are mixed
2 together, the alkali metal base is in the form of a preformed aqueous solution of alkali metal
3 base, and (i) is sulfamic acid in the form of a preformed slurry of sulfamic acid in water.

1 57. A method according to Claim 54 wherein said pH is in the range of from 12 to
2 about 13.5.

1 58. A process according to Claim 54 wherein said atom ratio is in the range of about
2 1.1:1 to about 1.5:1.

1 59. A method according to Claim 43 wherein the concentrated liquid biocide
2 composition further comprises an alkali metal bromide.

1 60. A method according to Claim 59 wherein the alkali metal is sodium.